SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

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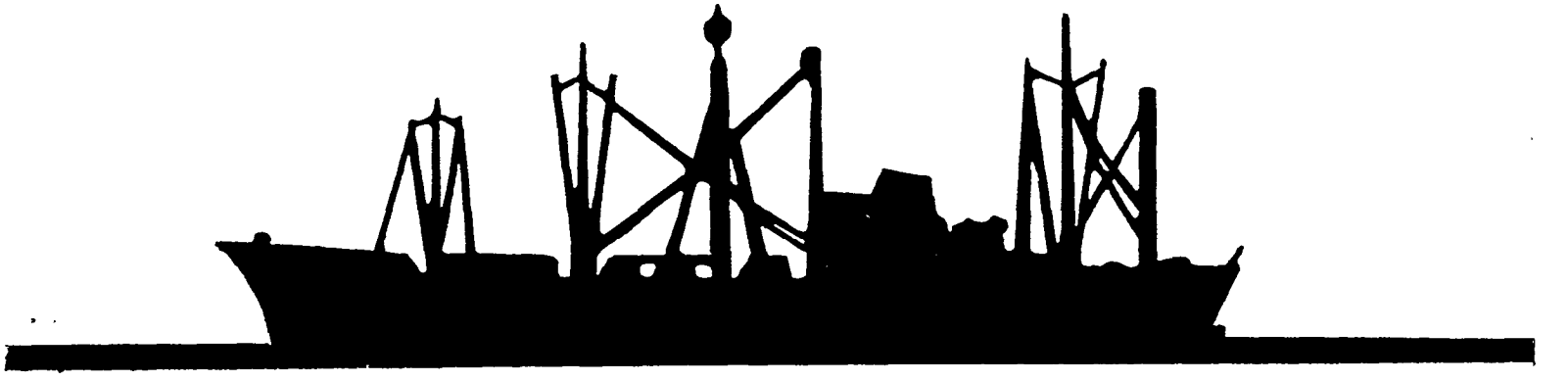

INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

INTERACTIVE COMPUTER SUPPORT FOR THE IMPROVEMENT OF PLANNING AND PRODUCTION CONTROL IN THE SHIPYARD ENVIRONMENT

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Florida

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Captain Bihr holds a BS degree in mechanical engineering from Rensselaer Polytechnic Institute. He holds a MS degree in management service from the U.S. Naval Postgraduate School. He has undertaken postgraduate studies in communications engineering and in mathematics.

ABSTRACT

Planning Research Corporation has been working with the U.S. Navy for the past 2½ years in providing a unique production management system for Navy Intermediate Maintenance Activities (IMAs). This system, successfully adapted from commercially proved techniques and underpinned by engineered labor performance standards, is in use at the Shore Intermediate Maintenance Activities (SIMA) Norfolk, Virginia and Mayport, Florida. Additionally, implementation of the system is underway on an incremental basis at SIMA, San Diego, California.

The engineered labor performance standards, developed as Engineered Time Values (E.T.V.), provide a means to accurately plan, schedule and progress work, to exercise production control on a real-time basis and to analyze factors affecting productivity in order to effect remedial action. A key feature of the Engineered Time Values (ETV) System is the Productivity Management Information Component (PMIC) which supports these functions through the use of interactive computer equipment.

In the planning function, ETV information resident in the PMIC is accessed by the assigned planner using a visual display terminal. The planner selects the operations required for the accomplishment of the work based on his job investigation. Using a conversational dialogue, the system provides a structured methodology guiding the planner through his normal mental process of planning the job while storing the planned data for further manipulation in a Jobs -in-Progress life cycle file. The ETV planning data is constructed around a permanent core of work steps based on a job hierarchial structure of key operations, tasks and components of work. Therefore, planning at all job levels is readily achieved. Once the job is planned and reviewed on the terminal, the planner *releases* the job to *a* printer for automatic printing of the job order, known in the E.T.V. System as a worksheet. The worksheet, in addition to listing the planned operations, displays a planned man-hour figure for the job which includes time for travel to the job site, job preparation and other allowances.

Scheduling and workload forecasting functions are also accomplished dynamically in the PMIC providing managers a real-time display of each shop's projected workload based on the planned man-hour figures generated for each job and the shop projected labor loading.

Work progressing and status information on each job are entered in the PMIC daily., Planned man-hours are automatically converted to earned man-hours as work on the job is completed. The resulting percentage of work completed on each job reflects actual job status in that the planned man-hour figure used is an aggregate of the engineered time values for the actual work steps involved in accomplishing the job,

As a result of the aforementioned PMIC applications, maintenance managers are provided an on-line production control capability by having at their fingertips actual remaining man-hour capacities in all shops for any given day of the current work week and for the upcoming work weeks. Therefore, the ability to optimize loading is available. This coupled with the additional PMIC functions of materials management, technical documentation support, status of labor availability, and plant/equipment capability provide a significant enhancement to the production control function. Dynamic, real-time computer assistance in the shipyard production management process can significantly improve the planning and control functions.

BACKGROUND

SYSTEM FEATURES TO BE DESCRIBED BASED ON:

- **ENGINEERED TIME VALUES SYSTEM FOR U.S. NAVY INTERMEDIATE MAINTENANCE ACTIVITIES**
- **REQUIREMENTS OF THE REPAIR ENVIRONMENT - NOT NEW CONSTRUCTION**
  - **RELATIVELY SHORT LEAD TIMES**
  - **FLEXIBILITY TO PLAN AND CONTROL WORK IN SUPPORT OF VOLATILE SHIP OPERATING SCHEDULES**

HOWEVER:

- **ADAPTABLE TO SHIPYARD REPAIR/OVERHAUL REQUIREMENTS**
- **APPLICABLE IN CONCEPT TO NEW CONSTRUCTION YARDS**

IMPROVEMENTS

IN

PLANNING

PROVIDED BY

- STANDARDIZED PLANNING DATA
- STRUCTURED PLANNING PROCESS
- SIMULTANEOUS MATERIALS IDENTIFICATION

STANDARD PLANNING DATA

IN COMPUTER

BASED ON

- INDUSTRIALLY ACCEPTED ENGINEERING STANDARDS

AND

- APPLICATION TO LOCAL SHOP WORK METHODS/PROCESSES

STRUCTURED, PLANNING PROCESS

PLANNER ACCESSES STANDARD DATA AND PLANS

- UNIQUE/CUSTOMIZED JOB
- REPETITIVE JOB

FOR UNIQUE/CUSTOMIZED JOBS

- STANDARD DATA ORGANIZED AND SELECTED HIERARCHIALLY

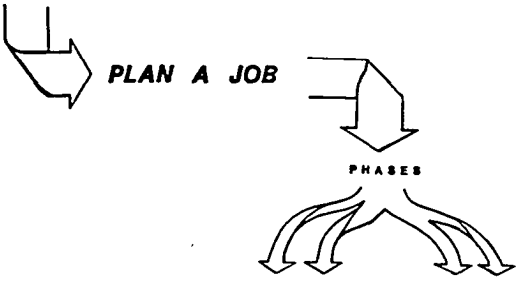
  KEY EVENT
  JOB
  KEY OPERATION
  TASK
  COMPONENT OF WORK
  WORK OPERATION

- PLANNER SELECTS WORK ELEMENTS AT LEVEL DESIRED BY MENU SELECTION - COMPUTER ACCUMULATES TASK TIMES

- COMPUTER PROMPTS PLANNER THROUGH HIS NORMAL MENTAL PLANNING PROCESS

- COMPUTER ADDS ALLOWANCES TO GENERATE PLANNED TIME
  - JOB PREPARATION
  - SHOP/SHIP/SHOP TRAVEL
  - SHIPBOARD WORK ENVIRONMENT COMPLEXITY FACTOR
  - PERSONAL/REST/DELAY

MENU CYCLE



JOB IDENTIFICATION

WORK COMPONENT SELECTION

WORK QUANTIFICATION DETERMINATION

PLANNING FACTORS APPLICATION

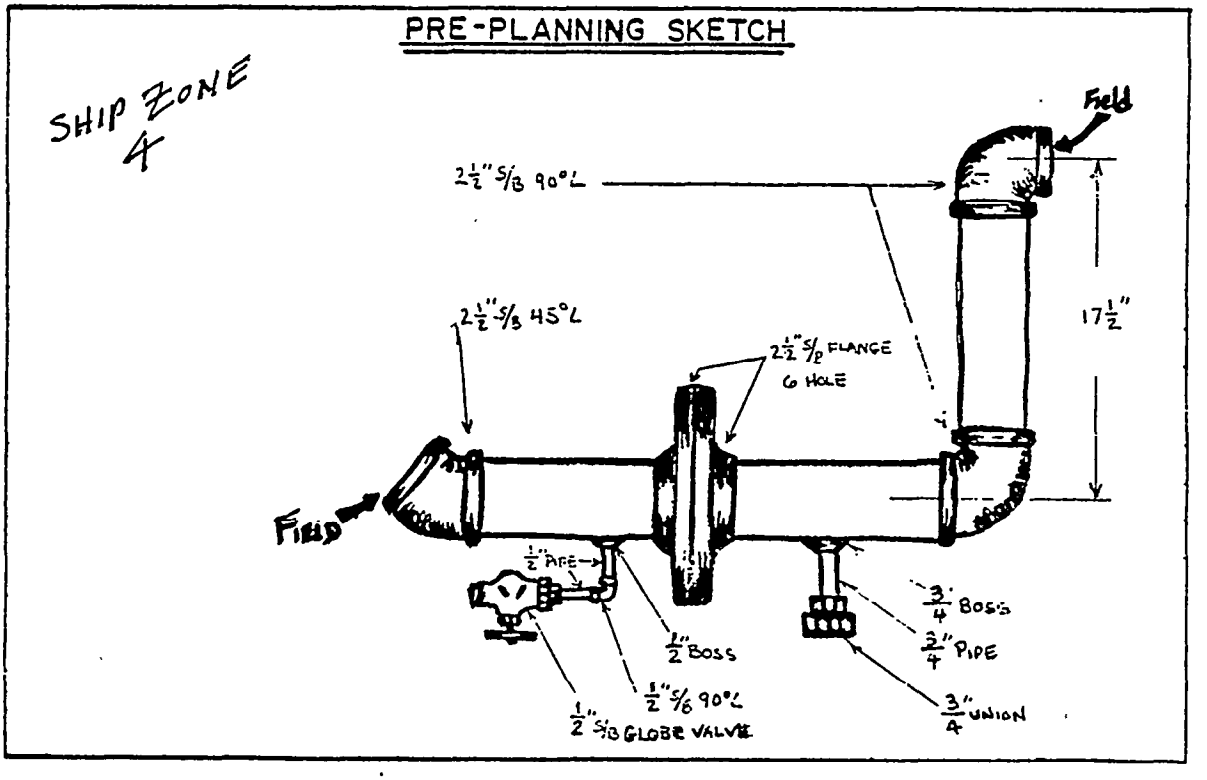
MENU CYCLE

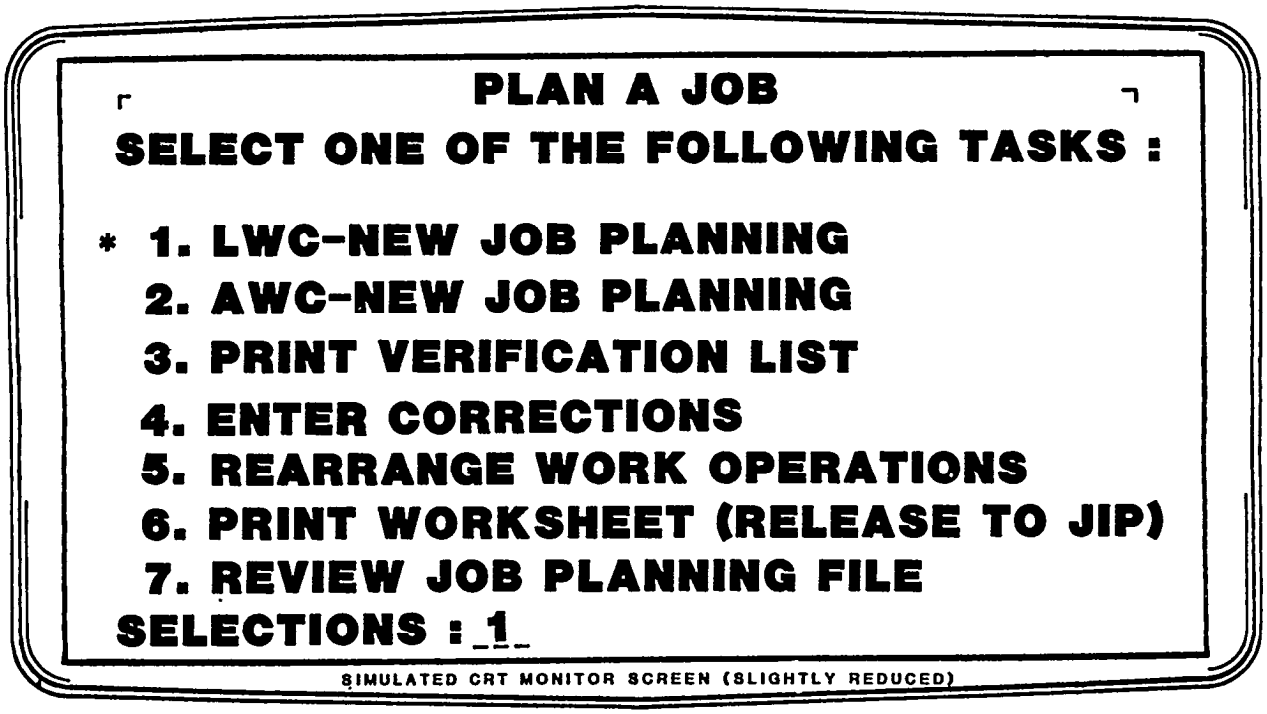
PLANNING / ESTIMATING MENU
SELECT ONE OF THE FOLLOWING :

1. MAINTAIN PLANNING FILE
* 2. PLAN A JOB
3. MAINTAIN SCHEDULING FILE
4. MAINTAIN PRE-PLANNED JOB FILE
5. REVIEW PRE-PLANNED JOB CATALOG
6. MAINTAIN JOBS-IN-PROGRESS FILE

SELECTION : 2

SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)





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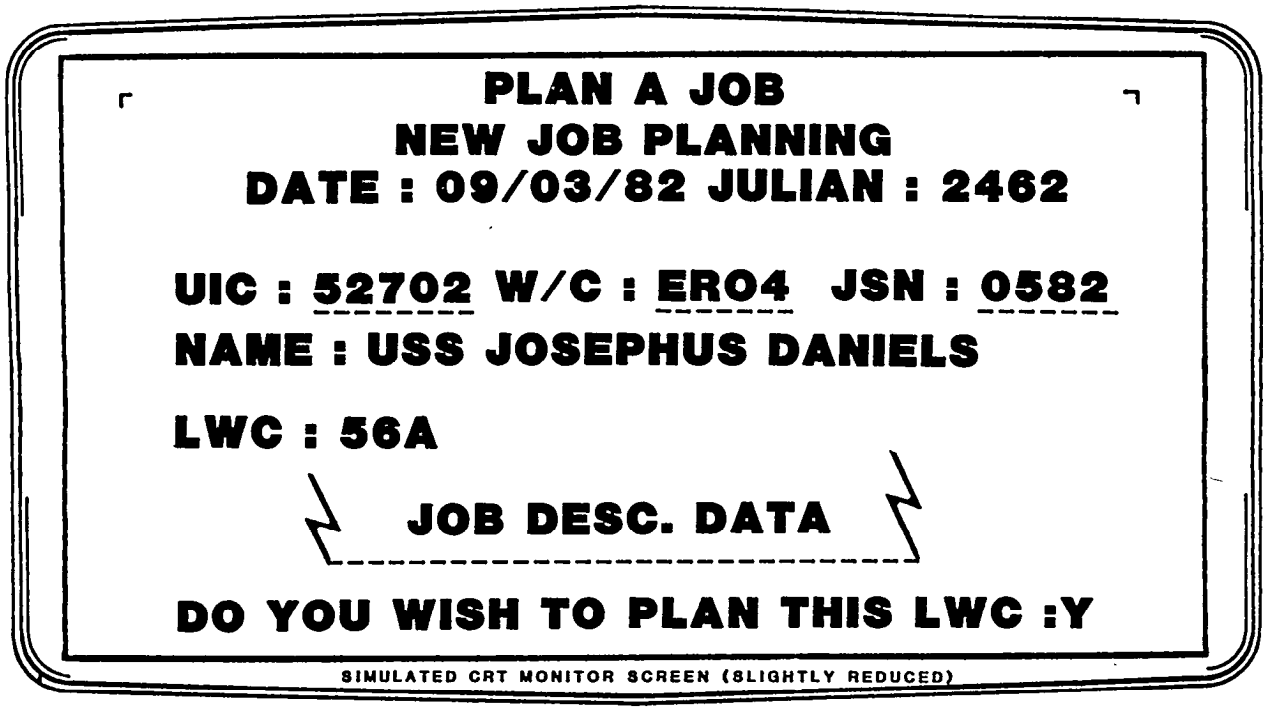

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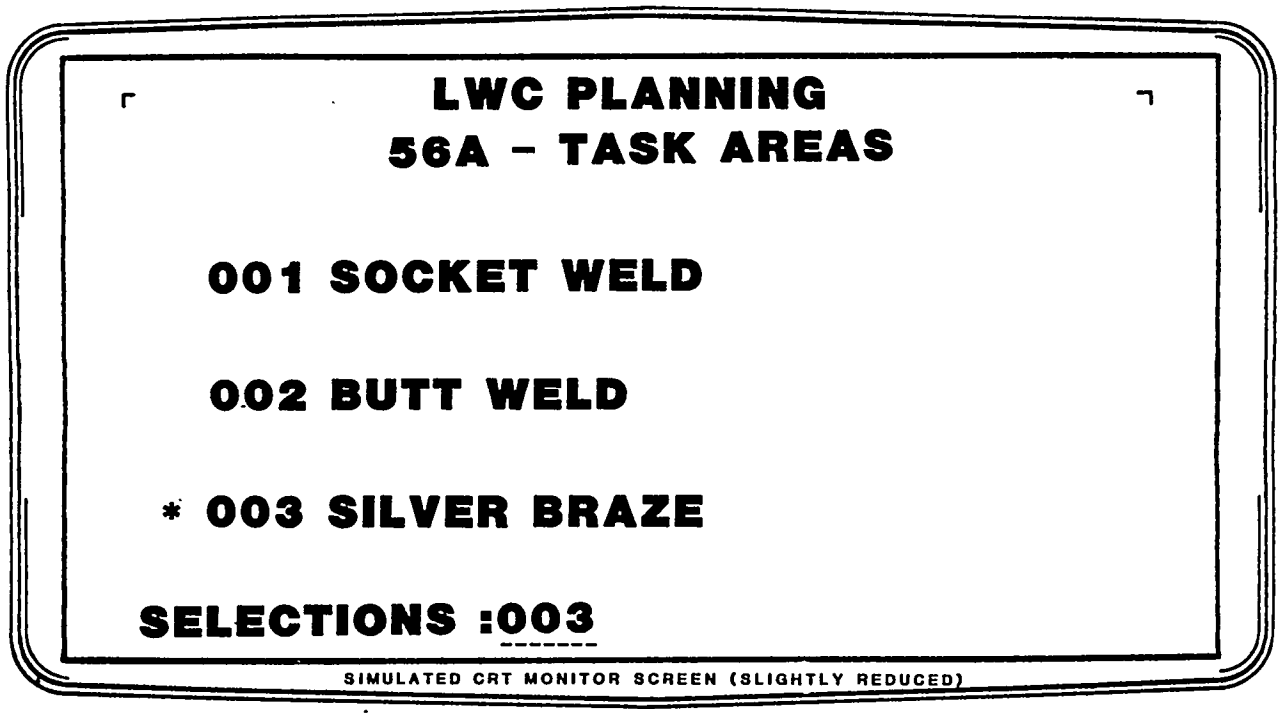

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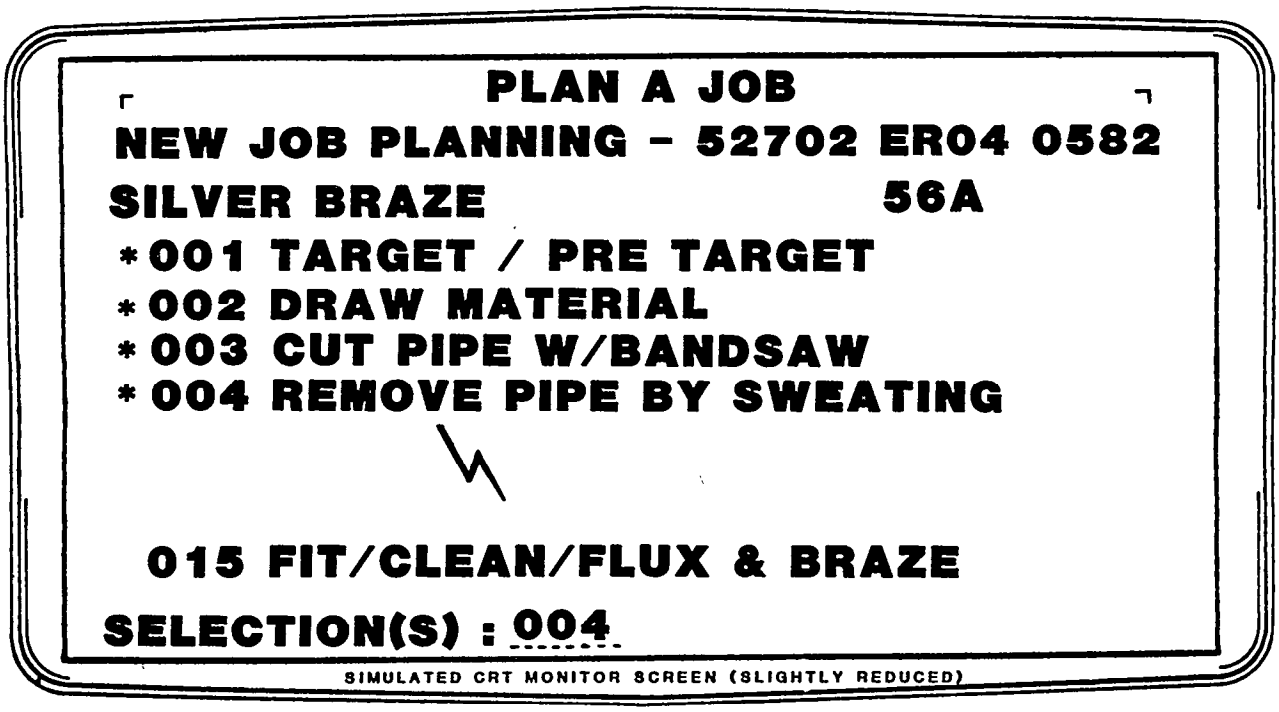

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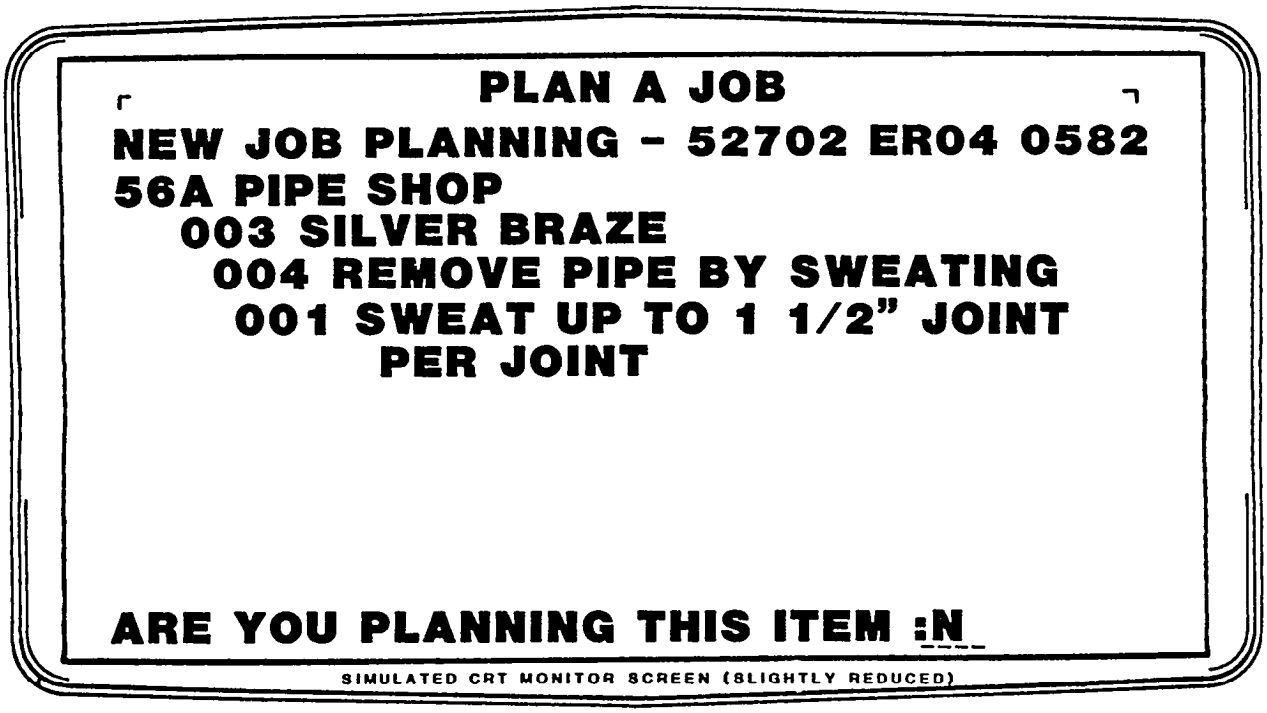

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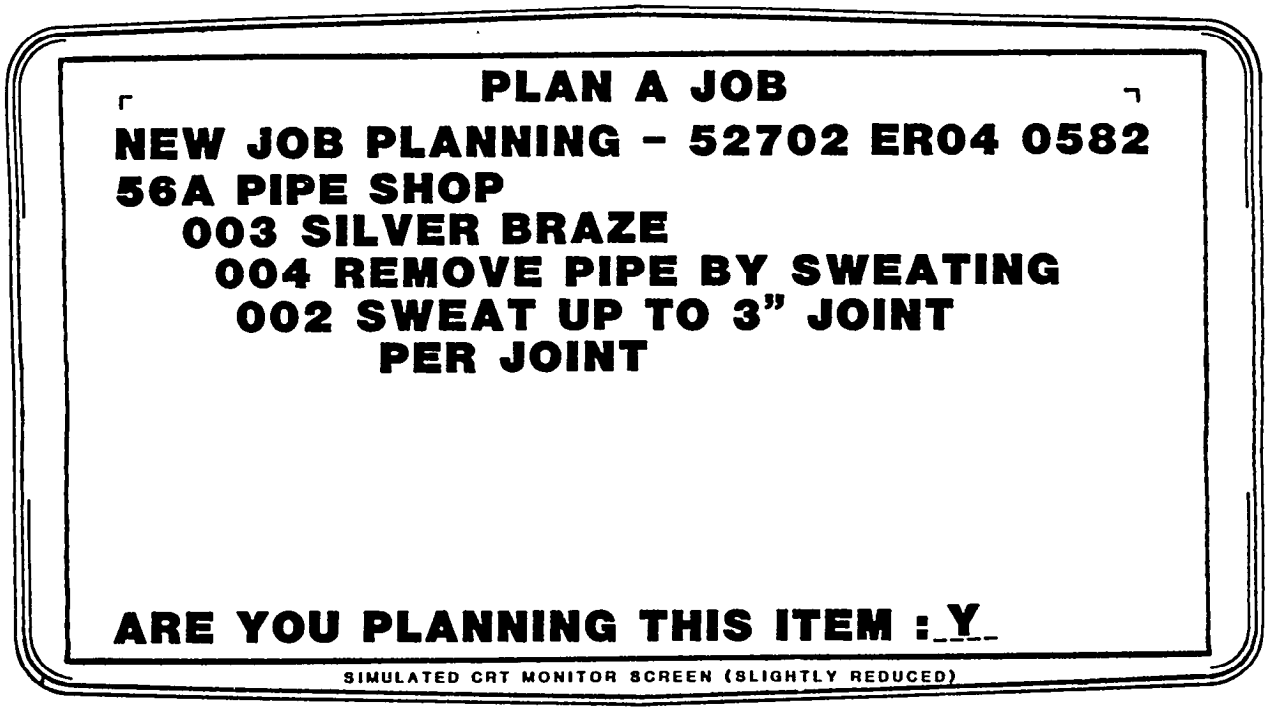

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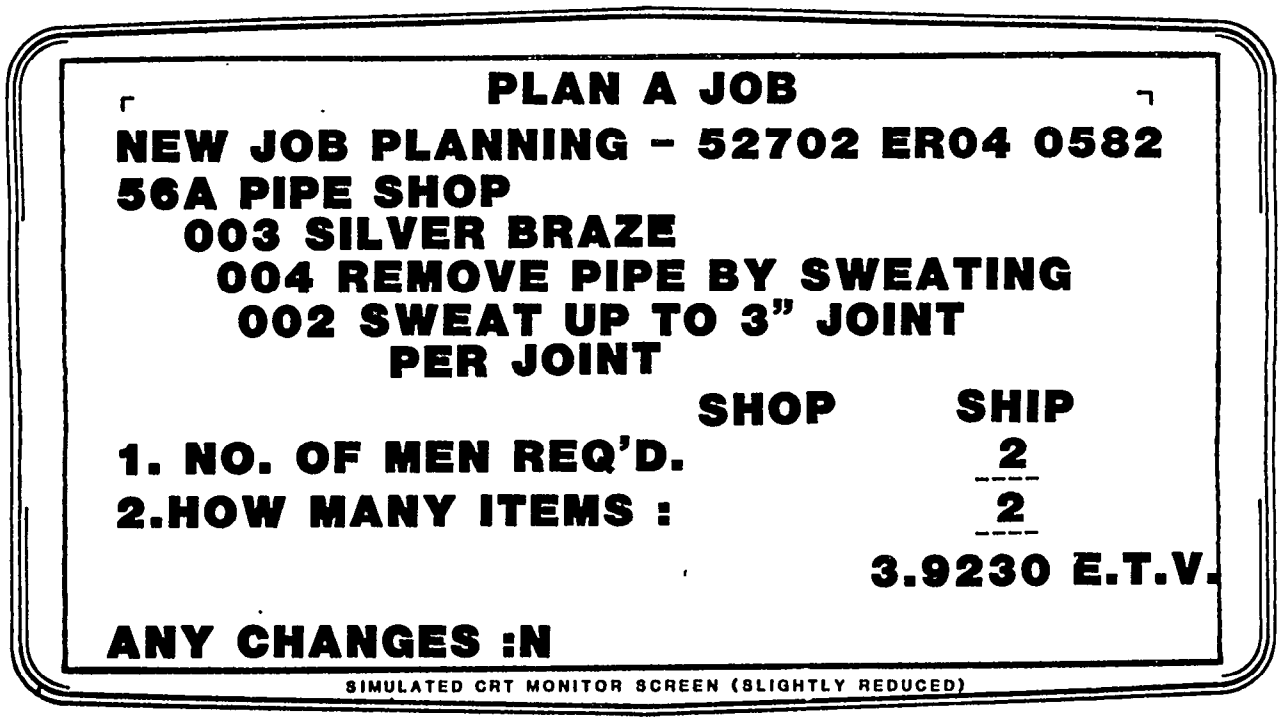

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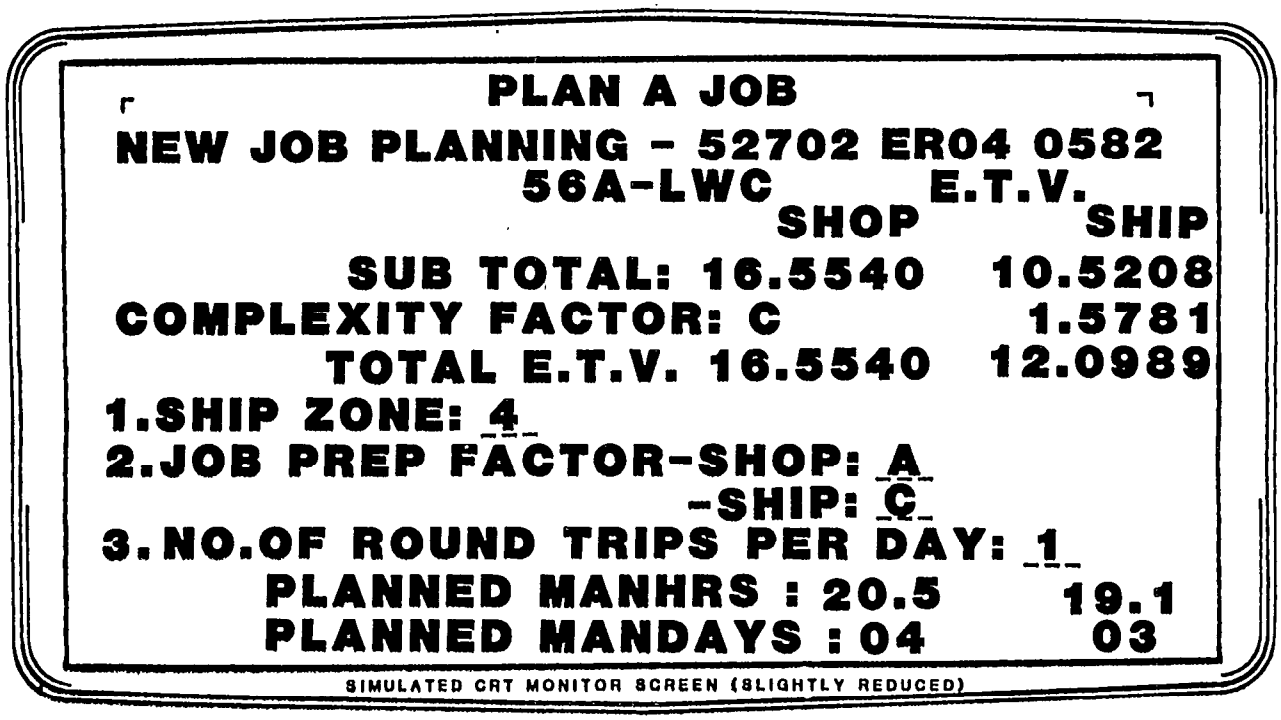


SIMULATED CRT MONITOR SCREEN (SLIGHTLY REDUCED)

FOR REPETITIVE JOBS

- SELECT PRE-PLANNED JOB ORDER
- ADD/DELETE WORK ELEMENTS AS NECESSARY
- SELECT ALLOWANCES AS IN CUSTOM JOB

THEN PLANNER

VERIFIES PLANNING STEPS ON VIDEO TERMINAL

PRINTS JOB ORDER

5AA - LUC   S H I P / S H O P   W O R K S H E E T

USS JOSEPHUS DANIELS   SIMA NORFOLK

UIC: 52702 W/C: ER04 JSN: 0782   PAGE: 1   09/03/82 @ 114?

SHIPBOARD COMPLEXITY FACTOR: C   PLNR: DON MC ANDREW

JOB DESC: REPLACE SECTION OF CHT SYSTEM   SHIP TRAVEL TIME ZONE: 4

IPT-SHIP = C   SHOP = (

RT-SHIP = 1   SHOP = (

REF NO	WORK TO BE PERFORMED	PLANNED — SHIP: M	QTY / E.T.V.	C	PLANNED — SHOP: M	QTY / E.T.V.	C
	SILVER BRAZE						
001	VERIFY SYSTEM TAGOUT CHECK TAGOUT (COSIGN) PER JOB		1 .5010				
002	SYSTEM DRAIN DOWN CRACK UNION/FLANGE PER UNION OR FL.		3 .3576				
003	REMOVE PIPE BY SWEATING SWEAT UP TO 3" JOINT PER JOINT		2 3.9230				
004	TARGET/PRE-TARGET (PER FL/BR) UP TO 4" (FLANGE) PER FLANGE OR BRACE					8 5.7980	
005	DRAW MATERIALS DRAW MATERIAL PER # OF PARTS					15 .0972	
006	CUT PIPE W/BANDSAW CUT UP TO 1 1/2" PIPE PER CUT					5 .1372	
007	CUT UP TO 3" PIPE PER CUT					6 .2050	
008	FIT/CLEAN/FLUX/& BRAZE FITUP (UP TO 1 1/2" JOINT) PER JOINT					8 5.3608	
009	FIT/CLEAN/FLUX/& BRAZE FITUP (UP TO 3" JOINT) PER JOINT					6 4.8750	
010	FITUP (UP TO 3" JOINT) PER JOINT		2 5.7392				

START	STOP			SHIP	SHOP
DATE:		PLANNED - MANHOURS:		19.1	20.5
			DAYS:	03	04
TIME:		TOTAL - MANHOURS:		39.6	

UNPLANNED COMPONENTS OF WORK:

NOTE: 1. COLUMN "M" INDICATES NUMBER OF MEN IF MORE THAN 1 MAN FOR SHOP WORK OR 2 MEN FOR SHIP WORK.
2. USE COLUMN "C" TO CHECK-OFF WORK COMPLETED.
3. UNPLANNED COMPONENTS OF WORK - LIST MASTER WORKSHEET INDEX NUMBER OF THE COMPONENTS OF WORK COMPLETED BUT UNPLANNED. ALSO SHOW QUANTITY IF APP

SYSTEMATIC MATERIALS IDENTIFICATION

MADE AT PLANNING TIME,

- PLANNER ENTERS MATERIAL REQUIREMENTS AGAINST JOB ORDER NUMBER
- INVENTORY AUTOMATICALLY ACCESSED FOR STATUS

IF ITEMS ON HAND:

INVENTORY ACCOUNT ADJUSTED

REQUIRED QUANTITY ADDED TO SUSPENSE ACCOUNT

PICKING TICKET PRINTED FOR PRE-STAGING

IF ITEMS NOT ON HAND:

JOB MATERIALS LIST (JML) PRINTED AT SUPPLY ORDER POINT FOR ACQUISITION ACTION

IMPROVEMENTS

IN

PRODUCTION CONTROL

PROVIDED BY

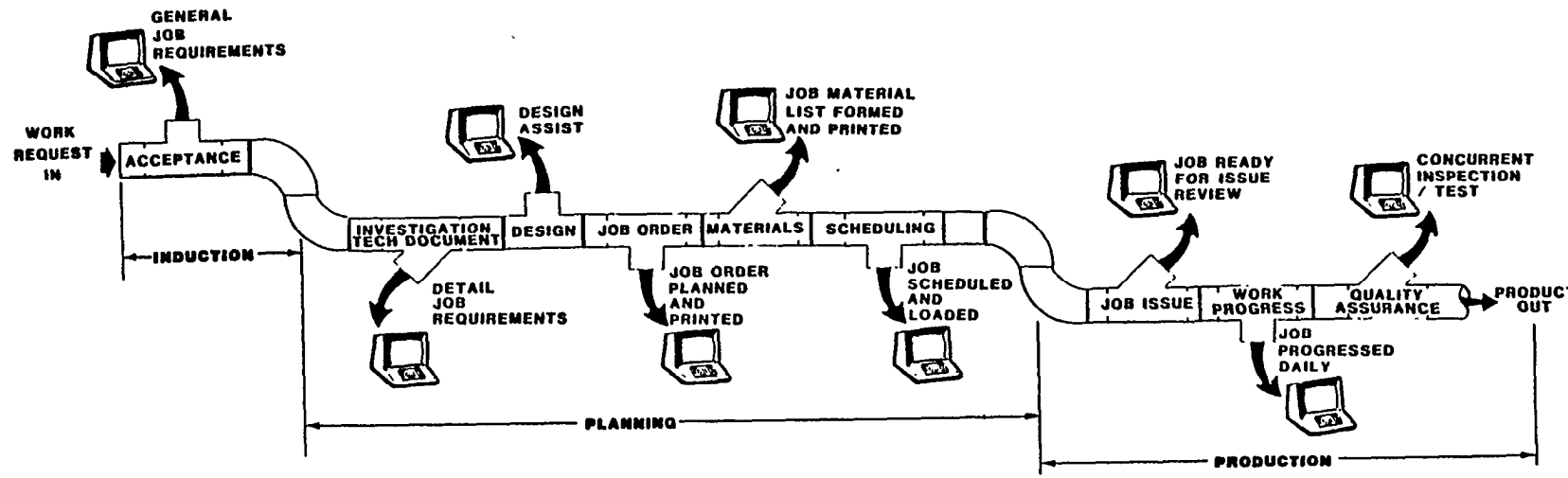
REAL-TIME DISPLAYS/REPORTS

SHOWING STATUS

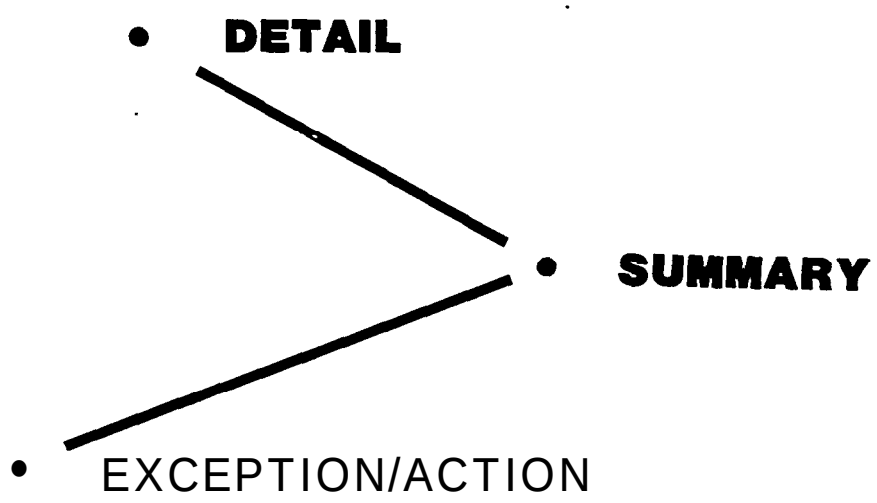
DURING ALL PHASES OF THE

PRODUCTION CONTROL PROCESS

THE FLOW OF PRODUCTION CONTROL



DISPLAYS/REPORT STRUCTURE



- JEOPARDY

INFORMATION PRODUCTION DISPLAYS/REPORTS

DISPLAY - DYNAMIC SCREEN PRESENTATION

REPORT - HARD COPY

ETV-PMIC/062 STATISTICAL SUMMARY - BY REPAIR DIVISION/GROUP SIMA NORFOLK

	UNASG	R1	R2	R3	R4	R5	OTHER	TOTAL
INDUCTED -----	0	11	15	4	3	1	4	38
PLANNING -----		96	334	41	25	52	5	553
OVRDUE ----		0	0	0	0	0	0	0
SCHEDULING ---		94	225	40	4	26	3	392
PLN HRS ---		2947	6585	1368	256	1064	92	12312
PREP TO ISS --		21	61	5	7	21	1	116
PLN HRS -		779	1839	132	250	113	16	3129
JOBS-IN-PROG -		131	269	55	31	110	0	596
REM HRS -		3973	6520	1457	843	2231	0	15024
TOTAL JOBS ---	0	353	904	145	70	210	13	1695

09/08/82 17:26:18

Simulated CRT Monitor Screen - Actual Size /Characters Slightly Reduced

ENGINEERED TIME VALUES
JOB STATUS UIC SUMMARY BY SHIP
DATE: 09/08/82 & TIME: 1829

SIMA NORFOLK
RPT NO: ETV681JTA
PAGE 1

UIC: 20068 USS AINSWORTH HULL: FF1090 AVAILABILITY: 0000330 - 0003000

W/C	JSN	CSMP SUMMARY	T/A	LWC	R/HR	O/O	LATEST DATE	CODE	REASON	ACTION REMARKS
EB01	2374	1A BLR CAL YARWAY INDECATOR	I4AV	41A	9		12AUG			SCH 27SEP2-01OCT2
EB01	2375	1B BLR YARWAY INDECATOR CAL.	I4AV	41A	9		12AUG			SCH 27SEP2-01OCT2
EB01	2391	OVHL VLV OPERATOR	E4RGNT	38A	1	90	31AUG	19	WAITG TECH DOC	RESCHEDULING
EB01	2414	REPLACE BACK FILL VLV	SIMAV	56A		100	07SEP			COMPLETED
EB01	2415	REPLC OUTLET 1/2" GLB VLV	SIMAV	56A		100	07SEP			COMPLETED
EB01	2423	MFG VEW S/W LINE	SIMAV	56A	5		08SEP			IN PROG-SC 12SEP2
EB01	2529	REPLACE BACK FILL VLV	SIMAV	56A	23	52	08SEP			IN PROG-SC 27AUG2
EB01	2534	REPLACE 1/2 INCH GLB VLV	SIMAV	56A		100	07SEP			COMPLETED
EM01	1284	BRIBBLE STUDS ON LP TURBIN	I4AV	38A	11	77	08SEP			IN PROG-SC 10SEP2
E401	1285	LUBE SUMP INDICATOR REPAIR	I4AV	56A		100	08SEP			COMPLETED
EM01	1300	REPAIR L/O STRAINER BASKET	SIMAV	17A	18		07SEP			I/S 13SEP2-17SEP2
ER01	1256	LOAD TEST AIRCRAFT TIE DOWNS	E/CSRP	72A	2		03SEP			I/S 06SEP2-10SEP2
ER01	1295	REPAIR SEPTAR BOAT	E/CSRP	64A	199	100	08SEP			IN PROG-SC 13AUG2
EXJC	R029	TSET INSPECT RELIEF VLV	I4AV	96A	3		17AUG	R6I	CANX BY S/F	PE REC REJ
EXSA	1221	NONE	SIMAV	11A			02AUG	R6I	MDC ERR	TYCOM REP REC REJ
EXSA	N760	OAC INSTALL SHIPALT FF-1052-52	SIMAV	56A	56		07SEP			I/S 13SEP2-17SEP2
SX01	0366	MFG PLAQUE BACKS	SIMAV	64A	29		08SEP			IN PROG-SC 26AUG2
WD01	1155	MFG LO SECUR BRACKETS	I4AV	11A	15		27AUG			I/S 06SEP2-10SEP2
WD01	1276	WEIGHT TEST BOAT DAVIT	E4RGNT	72A	31	31	02SEP			IN PROG-SC 13AUG2
WD01	1277	MFG PREVENTER SPAN LINE	E4RGNT	72A	11	47	31AUG			IN PROG-SC 20AUG2
WD01	1278	WEIGHT TEST BOAT DAVIT	E4RGNT	72A	30	33	13AUG			IN PROG-SC 13AUG2
WD01	1279	MFG DAVIT HEAD PREVENTER	E4RGNT	72A	12	40	31AUG			IN PROG-SC 20AUG2
WD01	1280	MFGDAVIT HEAD PREVENTER	E4RGNT	72A	4	81	31AUG			IN PROG-SC 20AUG2

IMPROVEMENTS IN PRODUCTION CONTROL

FURTHER PROVIDED BY

- ABILITY TO PROGRESS EACH JOB ACCURATELY
  - EARNED MAN-HOURS = % COMPLETE
- ABILITY TO MONITOR AND CONTROL WORKLOAD
  - BY SHOP
  - REMAINING LOAD VS UNUSED CAPACITY
  - OPTIMIZE RESOURCES
- ABILITY TO MONITOR PLANT CAPABILITY STATUS
  - END RUN CHOKE POINTS
- QUALITY ASSURANCE AUDIT TRAIL

IN SUMMARY

INTERACTIVE ADP EQUIPMENT OFFERS

- RESPONSIVE MANAGEMENT OF PLANNING/PRODUCTION CONTROL INFORMATION
- PROCESS DISCIPLINE
- READILY ACCESSIBLE HISTORY
- TRAINING CAPABILITIES
- PAPERWORK REDUCTION
- ENTRY TIME DATA VALIDATION/VERIFICATION
- GRAPHICS/NETWORKING CAPABILITY

INTERACTIVE SYSTEM
DEVELOPMENT RULES

- MODULARIZE, MODULARIZE AND MODULARIZE
- BUILD-IN TRANSPORTABILITY
- USE STRUCTURED PROGRAMMING TECHNIQUES - FROM THE BOTTOM - BUBBLE UP, NOT TRICKLE DOWN
- PROVIDE FREQUENT USER INTERCHANGE
  1. DESIGN AND FIELD CHECK
  2. DEVELOP AND FIELD CHECK
  3. TEST AND FIELD CHECK
  4. PLACE IN OPERATION AND FIELD CHECK
  5. DE-BUG AND FIELD CHECK
  6. GO TO 1.
- AUTOMATE INTERFACES - ONE TIME DATA ENTRY
- USE VIDEO DISPLAYS - ESCHEW REPORTS
- PROVIDE INFORMATION - NOT DATA
- EMPHASIZE MBE - USER PROVIDED CRITERIA
- PROVIDE JOB STATUS CONTINUOUSLY